ROCKS and MINERALS

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The official Journal of the Rocks and Minerals Association

Chips from the Quarry

A PLEA FOR THE REESTABLISHMENT OF A LAPIDARY DEPARTMENT

During the past few months quite a number of requests have been received from readers desiring that a lapidary department be a regular feature in ROCKS AND MINERALS. Below is a typical letter.

I like ROCKS AND MINERALS or I would not be taking it for so many years. I have no complaint or suggestion to make with one exception. When I started my original subscription you were running in each issue J. H. Howard's articles on lapidary technic, concerning which I have seen nothing regularly printed to equal them. I should like very much to see that department reestablished and appear regularly in the magazine. I have heard a number of others speak of a lapidary department in the same manner. Just a few days ago a friend remarked: "What is the use of my taking ROCKS AND MINERALS since there is nothing in it to be learned about cutting and polishing minerals—and I am trying to polish some in my collection."

Of course there are various phases of interest in minerals, and certainly lapidary work is one of them. If you can see your way clear, I should be greatly pleased to see the lapidary department reestablished.

Dr. H. L. Sayler
Dec. 6, 1943 Des Moines, Iowa

If readers will only cooperate by sending in notes and items which we can print, the lapidary department will again be a regular feature from now on. It was reopened in the last issue but we need more articles to keep it going. A large number of amateur lapidaries and even professionals subscribe for ROCKS AND MINERALS and if some of them would send in notes covering their methods of operation, discoveries, etc., the lapidary department would again be a regular feature. The previous department to which Dr. Sayler refers, ran from September, 1931, up to and including Nov., 1938. Who will be the first to send in an item?

Why the December Issue Was Late!

The December issue of ROCKS AND MINERALS was mailed on Dec. 4th but due to the extra heavy Christmas rush and lack of experienced clerks, many post offices held up the delivery of magazines. First class matter and packages only were handled by the post offices. This explains why some copies of ROCKS AND MINERALS were a month late in arriving.

A Mineral Exhibit in New Hampshire

A fine selection of choice minerals and fossils, part of the collection of Thomas A. Pine, of 66 Lake Ave., Manchester, N. H., was recently displayed in the foyer of the Carpenter Memorial Library in his city. Most, if not all, states in the Union were represented by fine specimens. The exhibit attracted considerable interest and a large number of people viewed it—many making repeated visits with friends.

Want An Apatite?

I have no minerals to sell but I have a large number of apatite crystals from Durango, Mexico, and will gladly send a perfect small one to any amateur collector who will write to me (especially a member of the "Old Timers Mineral Club"). A larger specimen will be sent to any "fan" who will write to me and send a specimen of something which he can spare.

Frederick H. Whitfield
Suite 415, 306 W. 3rd St.,
Los Angeles 13, Calif.

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Whole No. 151

CARL ANDERSON AND HIS LAPIS LAZULI MINE IN COLORADO

By OTIS DOZIER
Colorado Springs, Colo.

For three years we had been trying to get a chance to see the lapis lazuli mine, and to meet the discoverer of this blue gem stone.

We first became interested when Frank Morse, a colorful rock hound at Bayfield, Colorado, showed us a piece of the polished stone and we asked, "What is it?" "Lapis Lazuli, comes from Gunnison County," he replied. We could not imagine lapis lazuli coming from Colorado, so we had him explain all he knew about the stone, and we asked about the man who spent most of his time "back in the mountains" and brought out such unusual things.

On our way up to the Gunnison we stopped a truck driver and described the stone in detail. He had seen it—a fellow brought it from up in the mountains near Crested Butte. We might find out more at Sapinero, if we went there to inquire. It was only twenty miles out of the way, so we drove over (this was before gas rationing). Sapinero was a cold trail. Since our vacation was over, we went back to Colorado Springs, and hoped for another day and another time in Gunnison County.

The next time we saw the blue stone, it was in the museum in Denver, fully identified as lapis lazuli. Our interest flared up again twofold. We looked up the director, Mr. H. C. Markman, and asked more questions about the "man in the mountains." Yes, he was a miner-prospector called Carl Anderson. He came in to Crested Butte or Gunnison on occasions. From this conversation, we came to the conclusion that Carl Anderson was very young, a brilliant recluse, and *might* be hard to approach.

At last, two years later, we had a chance to take a few days off so we decided to go look up Carl Anderson and see the mine if possible. We went first to Gunnison where we had heard Mr. Anderson was represented by Mr. Harry Endner. There we saw cut and polished stones from the Gunnison district, and among them was the lapis lazuli, as blue and pyrite-bespangled as any of the finest Russian lapis. We asked more questions about Mr. Anderson, and proceeded to Crested Butte.

At Crested Butte, after some inquiry, we found another rock hound, Mrs. Bill Tully, who told us that Mr. Anderson was "back in the mountains" and came to town on Saturdays. She showed us some specimens from the district, including the Hessenite or cinnamon garnet, from Mr. Anderson's grossulerite mine. We were more anxious than ever to see where these wondeful things came from.

Since we were there on Thursday and Mr. Anderson was not expected down before Saturday, she directed us to a ranch house high in a valley where he *might* be. The drive up the canyon to that ranch house is one of the most beautiful I have seen in Colorado. The stream is the kind fishermen dream about.

The house was deserted, but it looked as if someone had been there recently, and there were "blue rocks" around so we knew we were at the right place, and left a note so he would get it as soon as he came in. As luck would have it, he

was having trouble with his car and had started into town. He found the note soon after we left, and followed us into the camp at Crested Butte.

We Meet Carl Anderson

We found him neither eccentric, cocky and young, nor anti-social. He has the modest dignity and quiet voice of a professor. There were no superlatives in his conversation, but his laconic description of the mine excited us more than anything we had heard since we became rock hounds. Needless to say, we were soon making plans to go next day up into the mountains to see for ourselves. He warned us it was quite a trip and advised an early start.

Early next morning we met him at the ranch house and drove for about ten miles farther up the canyon where Nature was outdoning herself to put frost crystals on every leaf and rock. The hills were at their best in autumn coloring, the aspen making patterns of neon yellow among the dark green pines. At the end of the "road" we loaded our lunch and handpicks in a knapsack, and hit the trail up the mountain. We walked miles, according to my wife, before we reached Mr. Anderson's cabin at timberline where we rested, condensed our lunch, and started our climb "Up".

The higher we got, the more exciting the country became. Sharp peaks were

Carl Anderson at his lapis lazuli mine high up on North Italian Mountain. Note the beautiful rugged mountain scenery in background.

rising on all sides. We were in the heart of the Elk Mountains. Then, at last, we were at the long sought spot where Mr. Anderson had first discovered lapis lazuli at an elevation of 12,500 feet on North Italian Mountain. (North Italian Mountain is 13,225 feet high). From there, he pointed out a lead mine that he was developing, and his grossularite mine which had yielded those beautiful specimens and cut stones of cinnamon garnet. From the same digging he had gotten vesuvianite crystals, epidote, and expects to find californite. Later, when we went over for a closer inspection, I found, literally, a cave of jewels—the kind of place every rock hound hopes to open up *some* day. The views from this place were breathtaking. We could see a hundred miles over row after row of sharp peaks, fading into blue distance and occasionally accented by cloud shadows. I have been on many mountains, but I have never seen such a turbulent and dramatically beautiful scene.

But such altitudes can brew fierce storms. While we were up there it snowed, hailed, rained, and sleeted. The clouds, looking fluffy and innocent, cut off the sun every few minutes and "scared" my wife frantic. She made

Mr. Anderson uncovers a fine specimen of lapis lazuli at his mine on North Italian Mountain.

much ado about crawling under a tarp in the shelter of a big rock and imaging us being rescued from a blizzard amid radio bulletins and heroic tales of our rescuers' progress. (We came down on our own power in a beautiful afternoon glow.)

How the Lapis Lazuli Was Discovered

It was due to one of these storms, the real thing, that this lapis was discovered. Mr. Anderson was working for the Star Mine on the other side of the mountain at the time of his discovery. It was time for him to do some assessment work on his grossulerite garnet claim. After the work was completed, he spent the night at his timberline cabin. Early the next morning a cold rain storm came up and he was due back at his job at the Star Mine. Due to the cold wind along the ridge where the trail was, he followed up a gulch, hoping to get some shelter from the north wind. Near the top of the gulch, he noticed a boulder of limestone that was highly crystallized with iron pyrite. This being out of the ordinary, he stopped to look it over and knocked off a chip with his hammer. On one side was a small spot of dark blue color which the rain had intensified—"copper stain"—and put it in his pocket. A few days later, he thought again of the blue rock in his pocket, looked at it under glass, and tested it.

To his amazement, it was Lapis Lazuli. His problem now was to have his identification verified, this was done by Dr. Stevens at The School of Mines at Golden, Colorado. The next after the verification was to find the main vein. The ridge from which the boulder had come was covered with timberline scrub of willow and other vegetation. There was no sign of an outcrop above. He finally decided to roll boulders down from above and see where they landed. If he went too high up the ridge, the boulders fell short of the original find; if too low, they went below. By this method he determined the proper spot to dig. Under three or four feet of dirt he found the vein which he has followed for several hundred yards around the side of the mountain. This was in the fall of 1939. So far as is known, this was the first gem quality Lapis Lazuli in the United States. Since that time, several authorities have pronounced it lapis of the finest quality. Mr. Whitmore, of the Smithsonian Institute, has said, "It has color and is equal to any of the specimens of this mineral from any of the localities represented in our collection."

The Lapis Lazuli Mine

North Italian Mountain is in the north central part of Gunnison County in western Colorado. The mine is on the west side of the mountain, 10 miles northeast of Crested Butte. The lapis vein is from a few inches to more than 2 feet in width, running for 200 feet along the hillside near the surface—therefore the diggings are only a few feet in depth. On one side of the lapis vein the rock is calcareous quartz, on the other side the rock is a greenish limestone.

Visiting such a place and meeting Carl Anderson, is something that happens to a rock hound only a few times in his whole career. With a man like Carl Anderson in such a rich district as Gunnison County, we can expect more gem stones in the future.

Collectors' Kinks — Three of Them

If a mineral that is to be tested for fluorescence needs to be washed, do not use soap as some soaps are fluorescent and will mislead the collector. Wash such specimens with dreft, a powder put up by Proctor & Gamble. Dreft not only does a better cleaning job than soap, but it leaves the mineral nice and clean—without a scum—and it isn't fluorescent.

To protect native silver specimens from tarnishing, coat them thinly with a colorless finger nail polish.

To hide tiny cracks and scratches in calcite crystals, cover them with 2 in 1 oil (or any other light oil). Do not use oil on fluorescent minerals as oils fluoresce. Donald Gabriel.

CONE-IN-CONE FORMATION ON COPPERAS MOUNTAIN, OHIO

By WALTER F. EISELE

Arcanum, Ohio

Here in Ohio mineral collectors are not very fortunate in the variety and color of our rocks and minerals but we do have a noted fossil territory. This territory extends through southwestern Ohio and over the state line into Indiana where in many a small rocky creek or crumbling ledge are found the remains of countless inhabitants of ancient seas. Many trips can be made in this region with discoveries of new deposits as a reward for the interested fossil collector.

ROCKS AND MINERALS for September, 1942, told of an interesting trip of R. Knille and J. Gibbs to Copperas Mountain near Bainbridge, Ohio. This locality is one of my favorite hunting places so I read their account with much interest.

A farm boy near Bainbridge told me one Sunday of a stratum of rock that could be found high up on Copperas Mountain. This stratum was called locally "The Ice Cream Rock", because, when struck a sharp blow with a hammer, a formation resembling an ice cream cone would pop out of the rock. This sounded most interesting and I resolved to investigate. I could see what I thought was the stratum the boy had in mind but it was about 50 feet below the top of the 300-foot cliff and as Copperas cannot be climbed, the only way to reach it would be from the top and without ropes that would be impossible. I regretfully gave up the attempt for that day.

However on the following Sunday, armed with a sturdy rope and aided by a husky friend, I again attacked Old Copperas. By going upstream (Paint Creek flows along the bottom of the cliff) and then climbing, where the cliff fell away, we were soon above the coveted stratum. With the end of the rope in the hands of my husky, long-suffering friend, and with a hammer in my belt, I slowly descended to where a light colored line of rock marked the suspected stratum. A few blows of my hammer disclosed a "cone-in-cone" formation that would delight the heart of any amateur collector like myself. This was the "Ice Cream Rock" and I obtained many nice specimens.

The boy had found specimens of the cone-in-cone formation along the base of the cliff and by looking upwards discovered the stratum in the cliff itself. The stratum is about 5 inches wide, 3 inches thick, and extends for about 400 feet along the cliff. It can be plainly seen from a distance but from the base of the cliff is almost hidden by the crumbling shale. Broken pieces of the stratum mixed with other rocks weathered out from the cliff are fairly plentiful along the base of the cliff but I could not at first pick out the cone-in-cone specimens until after seeing them in their natural position.

NEW GUINEA GOLD FIELDS RECAPTURED FROM JAPS

Papua, or British New Guinea, has been recaptured from the Japs and is now safely in the allied hands. Part of the Mandated Territory, bordering Papua on the north, has also been captured by the Allies. Press reports tells us that the gold mines in the Mandated Territory, the largest on the island, were never occupied by the Japs although they were bombed slightly. The mines are about 70 miles from the east coast, slightly southwest from Salamaua, the port of entry for the gold fields. The gold fields, which vary from 3,000 to 7,000 feet above sea level, were described in the January, 1943, issue of ROCKS AND MINERALS, pages 15-17.

BOOKENDS OF RARE BEAUTY

From Fluorescent Rocks Radiating Glorious Colors

By T. ORCHARD LISLE

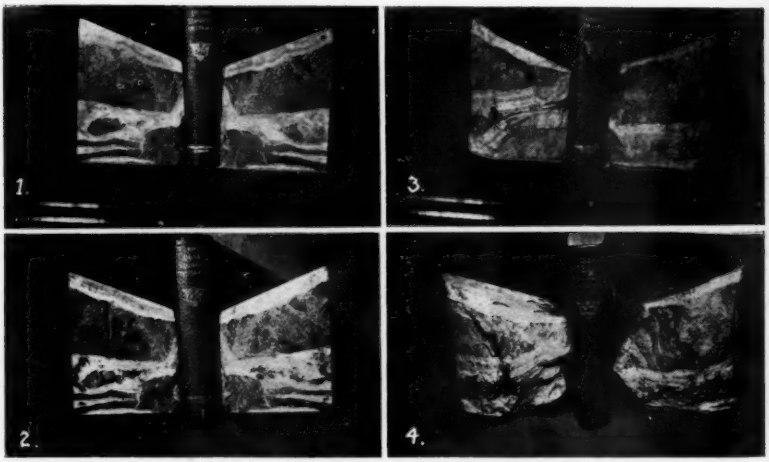
In 1940 my "better half" wrote an article for ROCKS AND MINERALS in which she told of the trials and tribulations of a rockhound's wife, and bewailed her sad lot for having to think, sleep, and eat minerals. At last she has confessed that I now have found something which is a joy and delight in her house.

Some weeks ago I was visiting the old Mirabel Quicksilver mine near Mount St. Helena on the road to Clear Lake, California, for the purpose of obtaining information for a mining journal on the mine's production of this strategic metal. The mine dates back from 1870, and except for one 20 year period has been constantly worked, including for 15 years by the present operators. The cinnabar, native quicksilver, and metacinnabar are found in lenses of silicified serpentine. Well crystallized dolomite is present as a gangue mineral. Sometimes the inch-wide bands of dolomite have small pockets of crude oil, as did the piece of rock about which I am writing.

From the mine dump I picked up several pieces of serpentine containing banded, or layered, dolomite. That night I placed the specimens under the black or violet-ray lamp and was astonished and delighted with the colorful beauty of the fluorescent reaction of the dolomite. Each layer of the dolomite seemed to emit a different brilliant color. I suspect that mixed with the dolomite there is some Curtisite—a hydrocarbon. Its reaction to the cold quartz light is not nearly as colorful.

The next morning I returned to the mine, and through the courtesy of T. O'Connor, superintendent, I selected several good-sized bowlders with the object of cutting them into bookends. I took care to make sure that these pieces contained plenty of banded dolomite in the matrix of attractive green and black serpentine.

One of the rocks I had sawn in half and polished on all sides but one, which was left in its natural state as this added



THE FLUORESCENT BOOKENDS
Nos. 1 and 3—taken with the ordinary photo-flood light.
Nos. 2 and 4—taken in the dark giving the negatives two seconds exposure to the ultra-violet rays.

to the daylight appearance of the bookends. This can be noted from the accompanying photographic illustrations. Under the ultra-violet rays they become the most gorgeous things any man could desire to have for his library. It is just as if brilliant rainbows were running through the rock—blues, reds, greens, and yellows and varying tones.

When the banded dolomite is sawn laterally—as with the flat tops of the bookends—even more vivid colors are revealed in profusion.

I decided to photograph the bookends under both an ordinary photo-flood light and under the ultra-violet rays, so as to show them under normal and fluorescent conditions, but the results rather surprised me. Note that in each case I photographed both the rough and flat-polished sides of the rocks.

I expected to see only a faint glow surrounded by blackness on the film taken under the violet rays from the 105-120 volt black lamp, but these pictures turned out to be clearer than those taken with the flood lamp. Nos. 1 and No. 3 were taken with the flood lamp, while Nos. 2 and 4 were taken in the dark giving the negatives two seconds exposure to the ultra-violet rays. With the latter there is, however, a more distinct whiteness to the dolomite bands, and this is definitely due to the fluorescence.

It is unfortunate that it is not practical for ROCKS AND MINERALS to print the illustrations in natural colors, because I would gladly photograph the bookends in Kodachrome under the ultra-violet rays in order that readers could see the full beauty of these "bits o' rock".

A HOT SULPHUR SPRING IN NORTH AFRICA

Here are a few lines on a hot sulphur spring which I had the opportunity to study a few weeks ago. I hope it may be of some interest to ROCKS AND MINERALS readers.

Of course the location cannot be given except that it is in North Africa. But the spring is near the base of a 900 foot cliff which is capped at the top by a layer of soft limestone and underlain by very soft shale which has been deeply eroded by rain. At a height of some 50 feet from the base, in a large cup-like amphitheater, the sulphur water comes through 7 or 8 holes in the bottom of a pool. Temperature of the water is about 130° F.

As the stream of warm water leaves on its way down the steep slope, it first begins to deposit a hard white mineral (probably calcite), then as the water cools it goes through a short stage of precipitating iron which rapidly becomes softer as the percentage of sulphur increases until it is pure.

The mineral content of the water is very high for it has coated blades of grass (still standing) as heavy as 1 to 1½ inches. And in one instance, the slipping of surrounding shale has cracked the formation showing that it is several feet thick but already the crack is beginning to mend itself.

In a general view from below, the stream flows out irregularly across the mineral which has the rounded appearance of a mass of flowstone.

Many strips of light pink gypsum, showing a crystalline structure, were observed in and around the spring, and one piece collected was almost transparent.

Pvt. Anthony Thurston, U. S. Army
(Somewhere in North Africa)
Home address—Swansea, Mass.

Waldemar Kurman

Just as we went to press, Harry Grahl, of New York City, sent us the sad news of the death of Waldemar Kurman, of Albany, N. Y. which took place suddenly on Dec. 21, 1943.

Mr. Kurman was a large, quiet man, an active collector who never missed a field trip of the Association. He will be greatly missed on future trips.

Mr. Kurman became a member of the Rocks and Minerals Association on March 11, 1935.

Born in Finland, he lived in the United States for 39 years (a resident of Albany, N. Y., for 30 years). He was a New York Central railroad fireman.

Mr. Kurman was widely known as an amateur mineralogist and had a large collection of minerals and fossils.

He was 55 years of age at the time of his death. His wife, the former Frances Knapp, is the only survivor. His home was at 52 Bradford Ave.

GEORGE LETCHWORTH ENGLISH

June 14, 1864 — January 2, 1944

George Letchworth English, one of the foremost mineralogists of the world, died Sunday morning, January 2, 1944, at his winter home at 225 Knowles Ave., Winter Park, Fla. He was 79 years of age.

Mr. English had been in retirement since 1935 and in recent months had suffered several attacks of illness. Since Nov. 10, 1943, when he suffered a severe heart attack, he had gradually grown weaker and weaker yet somedays would sit up for a short period and work on his new book "In the Field for Minerals". All this time he suffered from angina pains and for a week prior to his death he used over 300 nitroglycerine tablets as pains were so frequent, but they failed to dilate his blood vessels.

His son arrived at noon, Jan. 1st, and had a nice visit with his father who was conscious to the end. After being given morphine, Mr. English said to the doctor: "I believe, Doctor, I can go to sleep", and immediately the breath left him and his pains were gone forever.

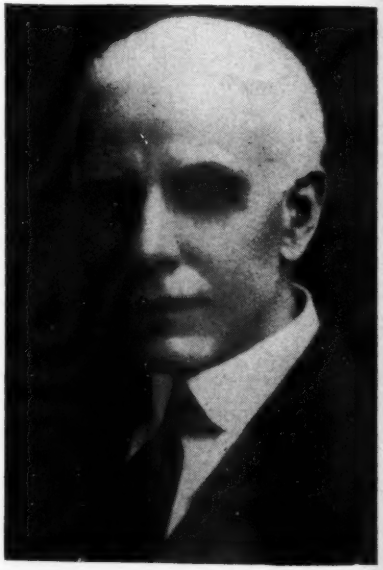
Mr. English was born in Philadelphia, Penn., on June 14, 1864, the son of John A. and Amanda (Evans) E., and was educated in that city at Friends' Central School from which he was graduated in June, 1881. For six years, after his graduation from school, he was employed by the Provident Life and Trust Co., of Philadelphia, and during the last year of this period he had been accumulating a large stock of good minerals from various localities.

In 1887, in partnership with Edwin C. Atkinson, he opened up his first mineral store at 1512 Chestnut St., Philadelphia. His stock of minerals was such an outstanding one—especially good were the Arizona azurites, malachites, and vanadinites—that collectors flocked to the store.

During the first six months after opening his store, Mr. English was almost constantly in the field collecting minerals. Pennsylvania, New Jersey, New York, Canada, and even Europe were visited and much fine material obtained.

In 1888 he visited localities in Colorado, Utah, California, Montana, etc. In 1889 still another trip was made to western localities, especially in the southwest as Texas, New Mexico, and Arizona.

In April, 1890, Mr. English moved his store to New York City and Wm. Niven, another great field collector, became a member of the now noted firm of Geo. L. English & Co. Mr. Niven made several trips to the southwest for the firm but he was a member for a short time only. As a matter of fact Mr. English purchased the interests of both his partners, Niven and Atkinson, in Dec.,



GEORGE LETCHWORTH ENGLISH

1892, and continued the store alone until he sold it on January 1, 1905, to Ward's Natural Science Est., in Rochester, N. Y.

On June 17, 1890, Mr. English married Louise T. Baltz. Three children were born to them: Gwendolen, Henry

Rowland, and Katherine Louise (dec.). Mrs. English died on March 10, 1920.

In 1891 the second European trip was made by Mr. English which included a visit to the world-famous silver-lead mines of Laurium, Greece, where he discovered the rare lead chloride, penfieldite —a white mineral formed by the action of sea water on ancient lead slags. Important localities in Sicily, Italy, Switzerland, and other European countries were also visited and huge quantities of choice minerals obtained.

It has been said that the 5 year period from 1887 to 1892 was one of the greatest in mineralogical history in America. Huge quantities of choice European minerals were imported and sold, and an even greater quantity of American minerals were likewise distributed among collectors. The famous rhodochrosites from Colorado, gorgeous red descloisites from New Mexico, topaz, hyalite, and rose garnet from Mexico, and the very fine brucite, chondrodite, magnetite, and titanites from Tilly Foster, N. Y., are only a few which made their appearance during this period. In addition some famous collections were sold by Mr. English, such as the Kunz collection to Thomas A. Edison, the Spang collection to the American Museum of Natural History.

In 1893, at the World's Columbian Exposition, in Chicago, Ill., Mr. English had a magnificent display of minerals and gems, valued at $20,000. Two medals and two diplomas were awarded Geo. L. English & Co. for this exhibit.

During 1894 and 1895, Mr. English spent most of his time mining monazite in North and South Carolina. He also made his third trip to Europe bringing back some more fine minerals for his stock.

In 1896, he made another trip to the west visiting Arizona, California, Colorado, Missouri, Montana, New Mexico, Utah, etc. One of the minerals brought back and which created a sensation was golden calcite from Joplin, Mo. The copper and iron mines of the Lake Superior district were also visited and fine specimens secured.

In the spring of 1898 he made his fourth trip to Europe and again many fine specimens were obtained. England, Norway, Sweden, Russia, Germany, Austria, Switzerland, Italy were some of the countries visited.

In addition to many trips made to localities, Mr. English also leased a number of abandoned mine and localities in general and worked them for mineral specimens.

On Jan. 1st, 1905, his store was sold to Ward's Natural Science Est., as has been said.

In 1903 Mr. English was again in the Carolinas mining monazite and after the sale of his store he devoted his entire time to this work. He was in charge of mining monazite from 1903 up to 1913 for the National Light and Thorium Corp., of Youngstown, Ohio.

In 1913 he became manager of the mineral department of Ward's Natural Science Est., Inc., which position he held until 1922 when he became consulting mineralogist for the same establishment until his retirement in 1934.

On March 29, 1923, Mr. English married Jane Parsons Hanna.

In 1920 and again in 1922, Mr. English visited Europe (England, France, Italy, Switzerland, Germany, etc.), which resulted in specimens to the value of $70,000 being purchased for the Establishment.

During the winter of 1924-1925, he again visited Europe (England, Norway, Sweden, Denmark, Germany, Switzerland, Belgium, and France) and another huge stock of minerals was purchased.

During the summer of 1926 a 10,000 mile trip to the far West was made visiting Montana, Idaho, all the Pacific Coast States, Nevada, Utah, and Colorado which likewise resulted in a large stock of choice minerals being obtained.

The greatest trip ever made by Mr. English, which covered about 50,000 miles, took place during 1927-1928. He left Rochester, N. Y., on Oct. 29, 1927, and returned Sept. 29th, 1928, having visited Europe, South Africa, Australia, Tasmania, New Zealand, and the Pacific Coast States. About $100,000 worth of

fine minerals were obtained as the result of this collecting expedition.

Mr. English was the first one to introduce the practice of having Exhibition Sales of minerals in New York and other cities. The outstanding sale and exhibit was that made in December, 1928, at the old Manhattan Square Hotel, New York City. At that exhibit approximately 2,000 specimens were placed on sale having an approximate value of $30,000. This was, without doubt, the greatest exhibit of minerals ever made by a dealer.

The following outstanding mineral collections were purchased by Mr. English for the Establishment:

Prof. T. S. C. Lowe, Pasadena, Calif. Collection of 6,000 specimens.

R. W. Forbes. Collection of 3,000 specimens.

John Graves, Frizington, England. Collection of English Minerals.

Otto Vautier, Geneva, Switzerland. Collection of Swiss Minerals.

Dr. Robert Herzenberg, Hamburg, Germany. General Collection.

The Broadbent Collection of Broken Hill, N. S. W., Minerals.

J. C. Bradley Collection. Chester, Penn.

H. H. Hodgkinson Collection, Franklin, N. J.

Boyce Collection of Franklin Minerals.

Merton Collection of Lake Superior Minerals.

E. W. Newton Collection. Camborne, Cornwall, England.

Part of the John Ruskin Collection.

Rochester Collection of Meteorites.

R. V. Engle Collection.

Mr. English has lectured on mineralogy for the New York City Board of Education and before various clubs and societies. He is the author of the very popular book "Getting Acquainted with Minerals"; also of "Descriptive List of the New Minerals 1892-1938; his new book "In the Field for Minerals" is ready for the press and should be out shortly. In 1904 he was invited to become an associate editor of the *Encyclopedia Americana* for which he prepared "A Catalogue of Minerals" and other articles on minerals.

Mr. English was a Fellow and Life Member of the Rochester Academy of Science (pres. 1919-21): member of the Philadelphia Academy of Sciences; Brooklyn Institute of Arts and Sciences (life); New York Mineralogical Club; Mineralogical Society of America (Vice-Pres. 1927); and the Rocks and Minerals Association.

Englishite, a white to colorless hydrous phosphate of calcium, potassium, and aluminum, a new mineral found near Fairfield, Utah, was named in his honor in 1930.

Mr. English's home was at 50 Brighton St., Rochester, N. Y. In addition to Mrs. English and his son, Prof. Henry Rowland English, of Madison, Wisc., he is survived by a daughter, Mrs. John K. Burleson of Berkeley, Calif., and six grandchildren.

PETER ZODAC.

Bibliographical Notes

Mineral Collectors Catalog: Ward's Natural Science Est., Inc., Box 24, Beechwood Sta., Rochester, N. Y., have just released their new mineral catalog, No. 441 (1944), which consists of 40 pages and 23 illustrations.

The main text consists of Fine Mineral Specimens (from all corners of the earth) listed alphabetically (pp. 3-16); Mineral Fluorescence is next (pp. 17-24); Collections for Mineral Study (pp. 25-27); Supplies for Mineralogy (pp. 28-30); and Books for the Mineralogist (pp. 31-35).

This very fine and most interesting catalog should be in the hands of every collector. Send for your copy today!

Trends in Petroleum Geology: By A. I. Levorsen.
Pub. 3713, pp. 227-234.

Meteorites and Their Metallic Constituents: By E. P. Henderson and Stuart H. Perry.
Pub. 3714, pp. 235-252, 6 pls.

Philippine Tektites and the Tektite Problem in General: By H. Otley Beyer.
Pub. 3715, pp. 253-260.

These three papers are from the Smithsonian Report for 1942.

Published by Smithsonian Institution, Washington, D. C.

Club and Society Notes

State Mineral Society of Texas

Mr. A. E. Curry of San Angelo, Texas, has been elected President of the State Mineral Society of Texas.

This Society includes all of Texas, both clubs and scattered individual members who are interested in the hobby of collecting rocks and minerals. In peace times yearly State meetings and shows are held. At present, members are trying to make a hobby work for Uncle Sam.

In addition to Mr. Curry the following officers have been elected for the duration of the war:

Vice-Pres.: Mr. L. H. Bridwell—Forestburg

Sec.-Treas.: Mrs. Viola Block—Dallas (829 W. Jefferson)

Historian: Mrs. Edith Owens—Honey Grove

Board of Directors:

D. W. Danielson—Muleshoe

Vance C. Tankersley—Miles

F. G. Hoskins—Eden

Wm. F. Dukes—Fort Worth

Milton L. Silberstein—Houston

Floyd V. Studer—Amarillo

Monthly News Letters are sent out to all members.

The Texas Mineral Society

Convened 8:00 P.M. Tues., January 11, 1944. Attendance 33.

The meeting was called to order and Mr. McIver introduced the speaker of the evening, Mr. Kintz of U. S. Bureau of Mines, who gave a fine lecture on Safety. A vote of thanks was extended to Mr. Kintz.

Pres. Copeland asked for an expression of Opinion on the Society having an Auction of Minerals at the Feb. 8th meeting. The motion was made by Mr. Jarvis and carried. Each member is asked to bring a specimen to be auctioned and the proceeds to be donated to the Society. Also, will get other specimens from a dealer and all above cost will be turned in to the Society.

The meeting adjourned at 10:00 P.M.

Mr. Copeland then sold mineral specimens received from a dealer for which 10% went to the Society.

Mrs. A. L. Jarvis, Sec.

Bridgeport Mineral Club

The Bridgeport Mineral Club had a meeting and Christmas party at the home of Mr. and Mrs. H. Pardon, in Bridgeport, Conn., on Mon., Dec. 20, 1943.

Mr. Pardon's collection was inspected. President Marshall entertained with talks on some of his travelling experiences.

A grab-bag was the next and most interesting feature of the meeting as the assortment in it was composed of 25 beautiful, all different, cabinet specimens from western states that were bought by the Club from W. Scott Lewis, of Hollywood, Calif., in which Mr. Lewis certainly outdid himself.

After the grabs, light lunch was served by Mrs. Pardon and the party broke up at 11:30 p.m., wishing all present a Merry Christmas.

San Jose Chapter of the Rocks and Minerals Association

On Friday evening, Nov. 26th, 1943, the Club met in the Science Building Lecture Hall, Rosicrucian Park, San Jose, Calif., and enjoyed an exhibit of fluorescent minerals.

On Friday evening, Dec. 10th, 1943, the Club met at the home of Mr. and Mrs. T. F. Rogers, on Hartford Ave., Jan. Jose. Twenty-one members were present and enjoyed refreshments and spent an interesting evening fingering over Mr. Rogers' display of lapidary work and discussing future field trips to be made after the duration.

The officers of the Club are:

President—H. C. Amens

Vice-Pres.—Ruth Stevenson

Sec.-Treas.—A. B. Strong

Director of Tours—Herbert Stockton

Dues are $3.00 a year, $2.00 of which is for membership in the Rocks and Minerals Association.

Error in the December Issue

Geo. W. Tintinger, of Great Falls, Mont., calls our attention to an error appearing in the article "Sapphires by the Bucketful", on page 369, December, 1943, of ROCKS AND MINERALS. In the article Phillipsburg was stated to be southeast of Helena—it should read *southwest.*

We regret this typographical error which was overlooked due to rush of work.

THE AMATEUR LAPIDARY

CUTTING GEMS BY HAND

Written by C. C. CURTIS and J. H. HOWARD

The cutting of gems is a branch of handicraft that has a wide appeal. But many men are deprived of the pleasure it can afford because they lack information as to how it can be done. There is a general belief that the cutting of gems requires special training, an elaborate shop and expensive equipment. This is not true.

Very satisfactory gems can be cut without machinery and with only such supplies as can, (in normal times) be gotten from any good hardware store. With one exception. A reasonable amount of patience is required and the hardware stores do not stock that.

As indicative of what can be done, we have seen a beautiful collection of real gems embracing calcite, agate, agatized wood, jasper, etc. that were cut with only a flattened piece of rusty stove pipe, a "nub" of a carborundum grinding wheel discarded by a garage, the leg of a worn-out boot, and a package of Bon Ami washing powder. Total cost: five cents for the washing powder. This technique is recommended only in case no better supplies can be had.

If the stone to be worked on is a pebble of the approximate size wanted in the finished stone, it is better to do all work on it by grinding. If a small gem is to be cut from a large piece of material, it should be sawed to the approximate size wanted.

Cementing For Sawing

Stones must be held firmly for sawing. This is best done by cementing them to a wood block. This block may be of any size or shape but one about ¾"x4"x 12" is suggested. If the stone to be cemented is very large proceed as follows: heat some chasers cement in a pan. Warm the stone. Warm a spot on the board somewhat larger than the stone. Pour some of the cement on the warm spot on the board. Dip the base of the warmed stone in the cement in the pan. Press the stone into the pool of cement on the board. As the cement cools, work that on the board into a bead around the base of the stone, using a small wood paddle or a putty knife or the wet fingers. The assembly is then allowed to cool before beginning sawing.

If the stone is smaller it may be easier to do the job with an alcohol lamp. Warm a spot on the board in the heat of the lamp. Hold a lump of cement in the heat at the same time. As the cement begins to melt, smear a spot of it on the block. Then warm the stone and smear its base with cement. Then hold the stone and the smeared spot on the block, in the heat at the same time. When the cement on both begins to melt, press them together and as the cement begins to cool build up the bead of cement around the base by pushing the partly fluid cement against the base. Some workers do this whole job with a soldering iron, preferably electric. Whatever method is used the essentials are the same, the stone and the block and the cement must all be sufficiently warm or they will not stick together.

Sawing

The wood block with the stone must be fastened to the workbench or table. This may be done with ordinary C-clamps, or, by boring two holes in the wood block and fastening it down with two wood screws.

The sawing is done with a smooth edged soft steel blade held taut in either a coping saw frame or a hacksaw frame, preferably the former. A sheet metal shop can furnish the blades. They should be about ½" wide by proper length for the frame used and of 24 ga. to 28 ga. sheet iron. Punch holes in the ends and adapt to the frame used.

In a small open vessel mix a thin mud of No. 100 or 120 carborundum

grains with clay flour or rottenstone or fullers earth with water. The earth is to make the mixtue sticky and prevent the carborundum grains settling out so quickly. With a small wood paddle apply a small amount of the mud to the top of the stone where the cut is to be begun. Drag the smooth blade lightly a few times across the stone, being careful to keep the blade always in the same place. Proceed as if sawing wood or steel. After the cut is well begun the pressure may be increased. The strokes should be short and fast, about 3" to 4" long. Saw must be very carefully held in one place until the cut is established. The repetition of this statement is deliberate. New mud must be applied almost continuously with the paddle in the left hand. It is to be applied against the side of the blade and is to be thin enough to allow it to run down to the bottom of the cut. A few drops of water flowed into the cut occasionally from a teaspoon or a medicine dropper or a rubber bulb such as an ear syringe will wash down to the bottom of the cut such grains as were adhering to the sides of the cut and will both speed the sawing and minimize the wearing of the side of the cut. Keep in mind that cutting is done only by the carborundum grains being dragged across the material by the smooth blade. The blade itself does no cutting. Therefore if no grains are between the saw edge and the material, no cutting is taking place. Note the importance of keeping plenty of grains in the cut and sufficiently liquid to flow to the bottom of the cut. As the grains dragged out of the cut collect at the sides of the stone, they may be scraped up and put back in the fresh mix. This cannot be continued indefinitely as the grains both break down in size and become dulled on their sharp edges and occasionally the mix should be thrown away and a new one made up.

If two or more cuts are to be made from one stone, do not cut any of them entirely thru until all have been cut nearly thru. Breaking away a sawed off slab weakens the anchorage and might cause the whole stone to break loose.

The blades wear both on their edges and on their sides. Do not start a new cut with a blade so worn that it might not finish the cut. If this is done and a new blade has to be used, the new blade will be too thick to enter the old cut.

Cementing on Stick For Flatting Base

Pressure is a big factor in the speed of grinding. One cannot apply sufficient pressure with one finger. Therefore the stone must be cemented onto a stick. The stick to be used in flatting the back should be round or nearly so, a little smaller in diameter than the stone and about an inch longer. It had best be pyramidal in shape. Warm the base of the pyramid and a lump of cement. As the cement melts, rub the base of the stick against the melted part and thereby build up on the stick a "wad" of cement. Then warm the stone and the cement and smear what will eventually be the top of the stone with the cement. Then warm the cement on the stick and that on the stone at the same time and press them together, being careful that the stone is at right angles to the stick. With the wet fingers, mould the warm cement carefully up against the stone to give a good bearing. Let cool.

Rough Grinding the Base

Provide a sheet metal pan about 4" wide by 8" long by about 1/4" deep. Put in the center of the pan about a teaspoonful of the same kind of mud used for sawing. Proceed to rub the stone in this mud until the surface is flat. Use heavy pressure. Keep abrasive pushed back into place and add fresh mud occasionally.

Alternate method: rub the stone on the flat side of a No. 100 carborundum wheel, or on the coarse side of a carborundum scythe sharpener until it is flat. Work must be kept thoroly wet. This scheme is preferred by some workers while others prefer the loose grains against metal. They are about the same speed. One disadvantage in using the stone is that it is impossible to keep the stone flat as it will gradually wear into a depression and grind a rounded surface instead of a flat one. *(To be continued)*

Clubs Affiliated With the Rocks and Minerals Association

ARIZONA

Mineralogical Society of Arizona
Geo. G. McKhann, Sec., 909 E. Willetta Street, Phoenix.
Meets at the Arizona Museum in Phoenix on the 1st and 3rd Thursday of each month.

CALIFORNIA

East Bay Mineral Society
Miss Ida Chittock, Sec., 1012 Elbert St., Oakland.
Meets on the 1st and 3rd Thursdays of each month (except July and August), at 8:00 p.m., in the Lincoln School Auditorium, 11th and Jackson Sts., Oakland.

Los Angeles Lapidary Society
J. H. McCormack, Sec., 4321 S. Raymond Ave., Los Angeles 37.
Meets on the 1st Monday of every month (on holidays its the following Monday) at 6:45 p.m. in the Friday Morning Club House, 940 S. Figueroa St., Los Angeles.

Northern California Mineral Society, Inc.
Mrs. Bernice V. Smith, Sec., 1091 Bush St., San Francisco.
Meets on the 3rd Wednesday of the month at the Public Library, San Francisco, at 8:00 p.m.

Pacific Mineral Society
Margaret Cotton, Sec., 2129—9th Ave., Los Angeles.
Meets on the 2nd Friday of each month at 6:30 p.m., at the Hershey Arms Hotel, 2600 Wilshire Blvd., Los Angeles.

San Jose Chapter of R. & M. Asso.
A. B. Strong, Sec., 1311 Cristina Ave., San Jose.

Southwest Mineralogists
Dorothy C. Craig, Corres. Sec., 4139 S. Van Ness Ave., Los Angeles.
Meets every Friday at 8:00 p.m., Harvard Playground, 6120 Denker Ave., Los Angeles.

COLORADO

Canon City Geology Club
F. C. Kessler, Sec., 1020 Macon Ave., Canon City.
Meets on the 1st and 2nd Saturdays of each month at 9:00 a.m. in the High School Building, Canon City.

CONNECTICUT

Bridgeport Mineral Club
Miss Georgianna Seward, Sec., 2859 Main St., Bridgeport.
Meets in the Bridgeport Public Library on the 3rd Monday of the month.

Mineralogical Club of Hartford
Miss Gladys L. Gage, Secretary, 239 Newbury St., Hartford.
Meets the 2nd Wednesday of each month, at 8:00 p.m., at 249 High St., Hartford.

New Haven Mineral Club
Mrs. Lillian M. Otersen, Sec., 16 Grove Place, West Haven.
Meets on the 2nd Monday of the month at the Y. W. C. A. on Howe St., New Haven.

IDAHO—OREGON

Snake River Gem Club
Frank S Zimmerman, Sec., Payette, Idaho.
Meets alternately in Payette, Idaho, and Ontario, Oregon, (two small cities on the Snake River) on the 3rd Tuesday of every month.

MAINE

Maine Mineralogical and Geological Society
Miss Jessie L. Beach, Sec., 6 Allen Avenue, Portland.
Meets last Friday of the month at 8 p.m., at the Northeastern Business College, 97 Danforth Street, Portland.

MASSACHUSETTS

Boston Mineral Club
Miss M. Gertrude Peet, Sec., 8 Willard St., Cambridge.
Meets on the 1st Tuesday of the month at 8:00 p.m., at the New England Museum of Natural History, 234 Berkeley St., Boston.

Connecticut Valley Mineral Club
Mary E. Flahive, Secretary, 96 South St., Florence.
Meets on the 1st Tuesday of each month at 8 p.m. at various institutions in the Connecticut Valley.

MISSOURI

National Geological Club
Mrs. D. P. Stockwell, Pres., Mt. Olympus, Kimmswick.

NEVADA

Reno Rocks and Minerals Study Club
Mrs. Rader L. Thompson, Sec., Box 349, R2, Reno.
Meets on the 1st Wednesday of each month, at 7:30 p.m., at the Mackay School of Mines, Reno.

NEW JERSEY

Newark Mineralogical Society
Louis Reamer, Secretary, 336 Elizabeth St., Orange.
Meets on the 1st Sunday of the month at 3 p.m. at Junior Hall, corner Orange and North 6th Streets, Newark.

New Jersey Mineralogical Society
G. R. Stilwell, Sec., 1023 W. 5th St., Plainfield.
Meets on the 1st Tuesday of the month at 8 p.m. at the Plainfield Public Library.

NEW MEXICO

New Mexico Mineral Society
R. M. Burnet, Sec.-Treas., Carlsbad.

Society of Archaeology, History and Art
Carlsbad.

NEW YORK

Queens Mineral Society
Mrs. Edward J. Marcin, Sec., 46-30—190th Street, Flushing.
Meets on the 1st Thursday of the month at 8 p.m. at 8501—118th St., Richmond Hill.

Rochester Academy of Science (Min. Sect.)
David E. Jensen, Recorder, 199 Eastbrook Rd., Pittsford.
Meets on the 2nd Thursday of the month at 8:00 p.m. at Bausch Hall, Rochester Museum of Arts & Sciences, East Ave., Rochester.

Rocks and Minerals Club of Nyack
Miss Ellen Lewin, Sec., c/o Dr. H. V. Krutz, 100 S. Broadway, Nyack.
Meets every Friday afternoon (except during summer) at 3:30 p.m. in the high school science room.

PENNSYLVANIA

Thomas Rock and Mineral Club
Mrs. W. Hersey Thomas, Pres., 145 East Gorgas Lane, Mt. Airy, Philadelphia.
Meets on the 3rd Friday of each month, at 8:00 p.m., at the home of its president, Mrs. Thomas.

TEXAS

Texas Mineral Society
Mrs. A. L. Jarvis, Sec., 353 W. Jefferson Ave., Dallas, Zone 8.
Meets at 8:00 p.m. on 2nd Tuesday of each month at the Baker Hotel, Mezzanine Parlor, Dallas.

State Mineral Society of Texas
Mrs. Viola Block, Sec., 829 W. Jefferson, Dallas.

VERMONT

Mineralogical Society of Springfield
Victor T. Johnson, Sec., 11 Elm Terrace, Springfield.
Meets on the 3rd Wednesday of each month at 8:00 p.m. at the homes of members.

WISCONSIN

Wisconsin Geological Society
Mrs. J. O. Montague, Sec., 1026 E. Pleasant St., Milwaukee.
Meets on the 1st Monday of each month at 8:00 p.m., at the Public Museum in Milwaukee.

Questions and Answers

Ques. A recent statement in ROCKS AND MINERALS seems questionable to me. The statement was: "Due to the crystalline nature of limestone, etc." I have always understood that limestone is non-crystalline and that if it is crystalline it would be marble. Will you please enlighten me? A. S., Waltham, Mass.

Ans. *All crystalline limestones are not marbles and all marbles are not limestones. The term "marble" is given to a soft rock which can take a good polish and is suitable for ornamental work, especially for interior use. Thus we have dolomitic marbles, onyx (aragonite) marbles, serpentine marbles, and limestone marbles (crystalline and non-crystalline). In other words a limestone, etc., becomes a marble only when it is used as such.*

We are glad that you called this to our attention as it is a matter of some importance. The word "limestone" is so loosely used by many writers that it is strange it was not brought up before. In general literature when the word "limestone" is used a reader does not know if a sedimentary non-crystalline rock is meant, or the metamorphic crystalline variety.

Ques. I would like to procure a specimen of tridymite crystals. Could you insert an S O S in your Ques. & Ans. section? I have written to several dealers and collectors but with no result. F. G. Knowlton, Barksdale, Wisc.

Ans. *We hope one of our readers may be able to furnish the specimen wanted.*

Ques. Do you know of a company from whom I can buy chemicals and apparatus for blowpipe work? D. R., Torrington, Conn.

Ans. *Denver Fire Clay Co., Denver, Colo.*

Ques. I would appreciate any available data on autunite as I can find nothing about this mineral in my mineralogies? S. R., New York, N. Y.

Ans. *Autunite is a hydrous phosphate of uranium and calcium. Its color is lemon- to sulphur-yellow. also greenish. Streak yellowish. Transparent to translucent. H. 2-2.5 G. 3.05-3.19. Occurs in thin tabular crystals or in foliated aggregates or scales with a micaceous structure. It is common in the pegmatite quarries of eastern U. S.—the finest specimens occur at the Ruggles pegmatite quarry near Grafton, N. H. Autunite fluoresces a bright yellowish-green under ultra violet lamps and this property distinguishes the greenish mineral from the greenish torbernite which is not fluorescent. Autunite received its name from Autun, France, where it was first found.*

With Our Dealers

Wyoming Minerals, of Laramie, Wyo., have just received a new shipment of fine quality nephrite jade from the Red Desert of Wyoming. We do not know where the Red Desert is located but we do know you would be pleased with the jade. How about ordering a good specimen?

A new advertiser to appear in this issue is Endners, of Gunnison, Colo., who is offering an old mineral (lapis lazuli) from a new locality (in Colorado). Of course you will want to order one or more specimens of this attractive blue mineral!

Weiner Mineral Co., of Tucson, Ariz., are with us again and again they are offering some highly colored, attractive Arizona minerals. These are just the minerals needed to rejuvenate dull and unattractive mineral collections. Even good collections can be improved with these unusually fine colorful Arizona minerals!

Another new advertiser to appear this month is the H. E. Powell Co., of Little Rock, Ark. And their offerings are some rare Arkansas minerals. What are these minerals? We suggest that you look their ad up to find out!

Ward's Natural Science Est., Inc., of Rochester, N. Y., continue to offer collectors new and attractive minerals from the world's foremost localities. They are also announcing the acquisition of some choice minerals from Franklin and Paterson, N. J., contained in a private collection recently purchased.

Still another new advertiser this month is J. L. Davis, of Hot Springs, Ark., whose specialty is quartz crystals of the finest water-clear quality. Some of the finest rock crystals in the world are found in the Hot Springs region of Arkansas. How many are you going to order?

Shale's Minerals, of Los Angeles, Calif., want to exchange fine xled minerals for some of your fine xled duplicates. Here is your opportunity to get rid of your excess material but it must be of good quality.

Lee Filer, of Central Valley, N. Y., recently acquired a nice stock of beautiful Brazilian amethyst. Brazilian amethyst is famous for its deep purple color. Why say more when you are going to order a nice specimen and see it for yourself.

Warner & Grieger, of Pasadena, Calif., are offering a large assortment of rough gem material of fine quality. Gem minerals have always been popular with collectors so this assortment will make a hit with them. Better rush your order for some of the minerals before their stock is exhausted!

Schortmann's Minerals, of Easthampton, Mass., still have a few choice gem peridot crystals from the world's greatest locality for this mineral. An opportunity such as this may never come again. Get your crystal today so that you will not be sorry tomorrow!

Allan Branham, of Lander, Wyo., has a nice assortment of slabbed Wyoming jade at attractive prices. These should appeal especially to amateur lapidaries of whom a large number take ROCKS AND MINERALS. Branham's jade is famous for its fine quality.

Something New! Wilfred C. Eyles, of Bayfield, Colo., offers to show the sights of his area to any member of the R. & M. A. who may call on him. Scenery—trout fishing—Indians—mountain climbing—mines—minerals—but you should stay at least a week in Bayfield. The area is big around Bayfield and so are the hearts of its citizens!

The Rockhound Colony at Bayfield, Colo., is growing fast—14 lots sold to date and all to rockhounds and more are coming in. Ideal location—mild winters—cool summers—finest scenery—virgin collecting country—in other words a Collector's Paradise! What are we waiting for! Write for further particulars to The Colorado Gem Co., Bayfield, Colo.

The West Coast Mineral Co., of La Habra, Calif., will surely intrigue collectors with their attractive offerings of some unusually nice agate modules. Do you like to be intrigued? We do!

We have one more new advertiser to announce which we purposely held to the last as a pleasant surprise for our readers. It is the Mineralogist Publishing Co., of Portland, Ore., and they are featuring one of the best known gem-cutting book in America. The book is "Art of Gem Cutting," by F. S. Young.

The Mineralogist Publishing Co., publishes *The Mineralogist*, a very worthy competitor of ROCKS AND MINERALS. The magazine comes out monthly, subscription price is $2.00 a year, and it features popular articles on mineralogy, geology, gemmology, and gem cutting.